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EDITORIAL.

REORGANISATION.

Field Division.

In the February number of the current volume of this Journal the Secretary for Agriculture drew attention to the work of the Assistant Agricultural Inspectors and urged that greater use should be made of the services of these Officers by Planters and others. In accordance with the general policy of decentralisation, it has recently been decided further to extend the duties of the Inspection Staff; to make the change clearer, this Division will, in future, be known as the Field Division, and the present Chief Agricultural Inspector and Assistant Agricultural Inspectors as Chief Field Officer and Agricultural Field Officers respectively.

The duties of the enlarged Division will be responsibility under the Secretary for Agriculture for:

(1) Control of pests and diseases of plants. Advice to agriculturists regarding plant sanitation. Demonstration of control measures. Enforcement of Agricultural Pests legislation.

(2) Demonstrations relative to crop improvement. Distribution of selected planting material to native agriculturists. Maintenance of Experiment Stations.

(3) Co-operation with District Officers in organisation of District Agricultural Shows.

(4) Co-operation with the Education Department with regard to School Gardens. Provision of seed and planting material for School Gardens.

The Agricultural Field Officers will be responsible to the Residents of their respective States for the local performance of these duties. Their work will be supervised on behalf of the Secretary for Agriculture by the Chief Field Officer, who will also give advice calculated to ensure uniformity of policy and will disseminate useful information obtained in any one State.

In technical matters the Agricultural Field Officers will continue to have the advice and co-operation of the Headquarters Research Staff. In all other respects they will be agricultural authorities for their respective States and should invariably be the first to be consulted by the general public on all matters of local agriculture.

Economics Division.

Some of the duties of the Field Division as now defined were formerly carried out by the Instruction Division. The new duties of the latter Division will be :

(*a*) The economics and marketing of agricultural products, especially the produce of small holdings.

(*b*) Liaison with the Co-operative Societies Department. Encouragement of the co-operative movement among native agriculturists.

(*c*) Conferences of Malay Officers and Agricultural Shows, excluding organisation of District Shows. (assistance to be given to the latter on request, but no part would be taken in administration of District Shows).

(*d*) Publication of the Malay Bulletin and educative pamphlets in Malay on questions concerned with agricultural economics and marketing.

The new title will be " Economics Division." It is felt that this separation and definition of the duties of the Economic and Field Divisions will prevent any possible overlapping and make for greater efficiency.

Accompanying these changes, arrangements have been made to provide within the Department an adequate training for the growing staff of Malay Officers : a member of the former Instruction Division has been placed in entire charge of their training. This officer will retain the title of "Agricultural Instructor (Malay Officers)."

Agricultural Divisions.

From the beginning of next year the Department will be relieved of the task of supervising three of the Government Plantations—Sapintas, Kuala Tembeling and Pondok Tanjong. Advantage will be taken of this change to reorganise the Agricultural Divisions.

From the 1st January the present " Agriculturist " will become the " Agriculturist (Rubber) " and will devote his whole time to this crop ; while the present Agriculturist, Government Plantations, will become the " Agriculturist " and will devote attention to crops other than rubber.

RECENT DEVELOPMENTS IN OIL PALM MACHINERY.

By B. J. Eaton.

THE problem of the most suitable type of machinery for the treatment of oil palm fruit, involving the separation of the pericarp from the fruit and the extraction of the palm oil from the pericarp has been under consideration for some years, especially by those interested in the cultivation of this crop on a plantation scale.

This problem is of importance from two points of view; firstly, the design of suitable plant for the native or for the small holder, and secondly, large scale factory plant for estate purposes. The latter point of view is at present of greater importance in Malaya, where the palm is being grown on a large scale, although a smaller type of plant suitable for the earlier stages of production on large estates is also of value.

The expression of oil, from the kernels need not concern the producer, since it is probable that the export of kernels will continue, the expression of the oil remaining in the hands of oil mills in the importing countries.

In an unpublished article written about two years ago, the writer discussed the possibility of extraction of palm oil from the pericarp by means of centrifugal machines instead of by hydraulic presses. It is of interest to note that this method is now an accomplished fact and, in the opinion of the writer, is a more efficient and economical process than that of hydraulic pressing.

Another interesting fact concerning this recent development is that the machinery has been designed by a British Company—Nigerian Products, Ltd.,—and constructed by one of the oldest oil expression machinery manufacturers in Great Britain—Messrs. Manlove Alliott and Co., Ltd., of Nottingham.

The writer has had the opportunity of seeing a complete plant of this type at work in the Nigerian Court of the West African Pavilion at the British Empire Exhibition, and has obtained from the makers an estimate of units capable of dealing respectively with 2 tons or 8-10 cwts of palm fruits per hour, which are included in this article. The makers also state that smaller units, even down to hand-power size, can be constructed.

Although it has not been possible to see in operation the plant designed by Culley Expressors, Ltd., and thus to make a comparison of the relative utility and efficiency of this plant with that constructed by Messrs. Manlove Alliott & Co., details of a Culley plant and an estimate of the cost as supplied by the makers are also given.

The essential difference between the two plants is that in the case of that by Manlove Alliott, no preliminary depericarping of the fruit is carried out, the whole fruit after a preliminary steaming in digesters being centrifuged for the extraction of oil. In the Culley process the fruit is first depericarped and the pericarp after steaming is centrifuged. In the absence of any comparative figures or a demonstration of a depericarper in operation the writer favours the Manlove Alliott process. In that process the pericarp is not removed from the nuts until after the palm oil has been separated in the centrifugal extractors. The separation of the pericarp is then a simple matter, especially if the residue of nut, with pericarp attached, has been passed through a suitable drier, preferably of the continuous rotary type.

Present Methods of Extraction.

Before dealing in detail with these latest processes for the extraction of the oil and separation of the kernels a brief description of the methods at present employed may be desirable.

The bunches of the fruit are removed from the palms by cutting with suitable knives and transported to collecting sheds. These sheds consist of long attap-roofed sheds, open at both ends. The bunches of fruit are placed on racks running the length of the sheds and composed of wooden or bamboo poles, with a sloping catchment shelf placed below. Many of the fruits ripen sufficiently to drop from the bunches within a few days. The fruits, which have not ripened sufficiently to drop from the bunches, are removed fairly easily by hand or by cutting close to the main stalks of the bunches. The detached fruits are then taken to the factory and treated as soon as possible, since it is well known that the oil from damaged fruit, or from fruit which is stored too long, deteriorates and contains a large percentage of free fatty acids, which reduces its value.

Mention might be made here of some experiments which have been carried out at the General Experiment Station A.V.R.O.S., Medan, Sumatra, employing a threshing machine for the mechanical separation of the fruits from the bunches. It has been suggested that, when working on a large scale, the method of first separating the fruits in the field, in addition to requiring the erection and maintenance of a large number of collecting sheds, may not be practicable.

In these experiments it was found that, although the separation of the fruits could be effected much more rapidly by threshing, the fruits were so bruised as to cause a considerable increase in the free fatty acid content. If, however, the bunches of fruit were sterilised by immersion in boiling water before passing through the threshing machine, it was found that there was no increase in the free fatty acid content of the resultant oil.

As compared with the method at present employed, the disadvantages are that approximately twice as much material (about half being waste) must be transported from the field to the factory and that larger heating vessels are required; the advantages are that no collecting sheds are necessary and that labour is reduced considerably.

In Malaya and the Dutch East Indies, the expression of the oil from the pericarp has been carried out hitherto in a somewhat primitive manner, using hand presses. The oil produced, however, has been of high quality containing, in the case of the Malayan product, less than 4 per cent. of free fatty acid (F.F.A.). In Sumatra, it is understood, estates have been satisfied with a F.F.A content of about 7 per cent.

Although, in the absence of suitable machinery, the methods of treatment of the fruit and expression have been described as primitive, this refers chiefly to the inefficiency of the process, whereby from 20 to 25 per cent. of oil remains in the pericarp and cannot be recovered except by efficient machinery.

The quality of the product—palm oil—is however, high, since the fruit is treated shortly after it reaches the factory and is subjected to heat by steaming, which prevents decomposition of the oil.

These primitive methods also require a considerable labour force in the factory, whereas the processes to be described are continuous and largely automatic.

Composition of Oil Palm Fruit.

The following table shows the average composition of oil palm fruit in Malaya :—

Pericarp 58 per cent.	...	Palm oil	31 per cent.
		Fibre & Moisture	27 per cent.
Nut 42 per cent.	...	Shell	35 per cent
		Kernel	7 per cent

Yields.

The following figures showing approximate yields will enable an estimate to be made of the capacity of the plant required for dealing with the crop, assuming that the fruits are collected regularly during the whole year. It is probable, however, that during certain months the crop may be considerably higher than at other periods, and allowance will have to be made for this factor.

Individual palms may yield from 6 to 10 bunches of fruit per annum and the weight of the bunches may vary from 75 to 150 lbs. In the case of palms planted 55 per acre (30 ft. × 30 ft. triangular equilateral) a yield of 1,250 lbs. of palm oil and 330 lbs. of kernels per acre per annum is a conservative estimate in the sixth year after planting, increasing to 1 ton of palm oil and $\frac{1}{4}$ ton of kernels per acre per annum with palms in full bearing. Assuming a yield of palm oil of 1 ton per acre per annum, this will involve the treatment of approximately 3 tons of fruit per acre per annum.

An estate of 1,000 acres would thus produce 3,000 tons of fruit per annum or 10 tons per day on a basis of 300 working days per

annum, involving the treatment of about 1 ton of fruit per hour, assuming a 10 hour working day.

The writer is of the opinion, however, in view of the variations in yield during different seasons, that a plant capable of treating 2 tons of fruit per hour would be advisable for a 1,000 acre estate, although it is possible that such a plant will be found capable of dealing with the crop from a larger area.

Manlove Alliott Process.

The plant designed by Nigerian Products, Ltd., and constructed by Messrs. Manlove Alliott & Co., Ltd., is the result of experience gained in the mechanical treatment of the fruit in West Africa.

The original plant consisted of depericarpers and hydraulic presses with the necessary steam kettles for heating the fruit and pericarp. After a short period this type of plant was discarded and centrifugal machines installed for the separation of the palm oil from the whole fruit. This method has been found to give improved results, to be less costly and more efficient.

The process is as follows: The fruit is fed by means of a conveyor into a receiving hopper which feeds a vertical cylindrical digester. In the complete plant, details of which will be given later, two digesters and three centrifugal extractors, with an extra "basket," are employed, so that one extractor is available for filling or emptying, while the remaining two are in operation.

Each digester holds about 30 cwt. of fruit and is fitted with a vertical shaft and agitators. Steam about 3 lbs. above atmospheric pressure is introduced and the charge heated for 15 to 30 minutes. The heated fruit is discharged into a "creeper" feeding the centrifugal extractors.

Each extractor is fitted with a removable basket holding 5 cwt. of fruit and the charge is centrifuged for about 10 minutes. The palm oil is "thrown" through the perforated basket and discharged by a pipe in the outer casing of the centrifugal extractor into tanks placed on or below the surface of the ground. Steam is also injected into the centrifugals to assist the extraction of the oil.

The oil is then pumped into large settling tanks and, if necessary, heated by means of steam coils to allow the settlement of any coagulable or suspended matter. From the settling tanks the oil is discharged into storage tanks from which it is drawn off into barrels as required.

After the mass has been centrifuged the "basket" is lifted by means of chain blocks and carried by an overhead runway to a hopper feeding a rotary drier. This consists of a long cylindrical vessel, with the necessary baffle plates, mounted on a shaft slightly inclined

to the horizontal, so that the residual nuts and pericarp travel continuously from the higher to the lower end. This takes about 20 minutes by which time the nuts and pericarp are practically dry.

The baffle plates fixed on the sides of the cylinder lift the massed nuts and fibre and separate them, so that when the dried material is discharged the nuts are practically free from adhering fibre. The driver is rotated by an external cog-wheel and is heated internally by means of hot exhaust gases from a boiler.

The dried nuts and pericarp are then fed by means of an elevator on to a horizontal rotary screen mounted on a shaft in a tank or box, in which the separation is completed The fibre falls through the meshes of the screen and is used as fuel for the boilers, while the nuts are discharged into an elevator feeding two nut-cracking machines placed side by side. These machines are driven through a countershaft at about 1,000 revolutions per minute. After cracking, the shells and kernels fall direct on to a shaker screen, recovering any uncracked nuts, which are discharged into a separate bin to be returned to the nut crackers.

The kernels and the cracked shells fall through the meshes of the screen into a brine bath below. The density of the brine is such that the kernels float while the shells sink. (Note:—In Malaya and Sumatra, a bath of clay in suspension in water has hitherto been used for this purpose owing to the cost of salt,, but with the recovery of the brine as practised in the process under review, the use of the brine bath appears to be more satisfacfory).

The bottom of the brine tank is fitted with a spiral conveyor which takes the shells to one end, where they are discharged into a receiving hopper, feeding a centrifuge in which the brine adhering to the shell is extracted and returned to the brine bath. The shells, which are almost dry, are then taken by means of an overhead runway to the boiler furnaces and used as fuel.

The kernels are skimmed from the surface of the brine bath by means of wire baskets and allowed to stand for a few minutes on a sloping tray to drain. They are then fed into another centrifuge, which separates the adhering brine. The kernels are then ready for immediate bagging for shipment.

The necessary steam for the whole plant, that is for the digester and the centrifugal extractors, can be raised by using the dried pericarp fibre and shells as fuel. The shells can, if necessary, be converted into charcoal, suitable for the manufacture of suction gas for the necessary power required.

The whole plant is designed with the object of saving labour and is practically automatic, for example only two operators are employed on the plant working at the British Empire Exhibition.

The following estimate and details have been supplied by Messrs. Manlove Aliott & Co :—

(Note :—The detailed descriptions of the various items have been omitted in order to save space ; only the names of the essential parts of the plant are given).

(a) *Capacity 2 tons of palm fruit per hour.*

The items are as follows :—

(1) Elevator for raising fruit to receiving bin for digesters.

(2) Mild steel fruit receiving bin.

(3) Two mild steel fruit digesters, 30 ins. diameter, capacity of each—1 ton of fruit per hour.

(4) Receiving hopper for delivering fruit from digesters to centrifugal extractors.

(5) Three centrifugal extractors.

(6) Two sets of lifting tackle to raise baskets from centrifugal extractors.

(7) Structural iron work for carrying digesters, countershaft and elevator.

(8) Runway with supporting columns.

(9) Two mild steel hoppers for receiving nuts and fibre from centrifugals.

(10) Spiral conveyor to convey nuts and fibre to elevator for rotary driver.

(11) Mild steel rotary driver with suction fan.

(12) Mild steel flue piping from boiler to drier, drier to fan, fan to atmosphere.

(13) Two elevators for raising nuts and fibre to separating screen.

(14) Nut and fibre separating screen with steel frame work and driving gear.

(15) Spiral conveyor from screen to elevator.

(16) Elevator to raise nuts to cracking machines.

(17) Two nut cracking machines with automatic worm feed.

(18) Shaker screen for separating uncracked nuts.

(19) Structural iron work for supporting nut crackers, screen and driving gear.

(20) Cast iron brine tank with shell conveyor.

(21) Kernel skimmers.

(22) Drip tray for receiving kernels.

(23) Shell conveyor with buckets, chains and driving gear to convey shells from brine bath to centrifuge.

(24) Mild steel shell bin for removing shells from elevator to centrifuge.

(25) Structural iron work for supporting shell bin.

(26) Two centrifuges for drying shells and kernels.

(27) Two runways with supports, and two sets of lifting tackle to lift baskets from centrifuges.

Total price of the above plant £4,324.0.0, plus 6 per cent. for packing for shipment and delivery f.o.b. English port.

The whole of the necessary mild steel shafting for driving the above machinery, including main and countershafts, necessary support frames and pulleys (except pulley receiving power from engine, and belting) £273.0.0, plus 6 per cent. for packing for shipment and delivery f.o.b. English port.

The following steam power plant for driving is recommended :—

(1) Two horizontal multitubular circular fire box boilers (Robey & Co.,) working pressure of 80 lbs. per square inch and capacity of 2,500 lbs. of steam per hour, using wood fuel or shell or fibre refuse, fitted with donkey pump and injector for alternative feeding. Price £1,060.0.0, packed for shipment and delivered f.o.b. Liverpool.

(2) Improved double cylinder medium stroke horizontal steam engine (Robey & Co.). Price £489.10.0, packed for shipment and delivered f.o.b. Liverpool.

The following are the details of the storage tanks for the palm oil :—

(1) Tank for receiving palm oil from the centrifugal extractors, 5 ft. × 5 ft. × 3 ft. Price £35.0.0.

(2) Oil storage tank of 25 tons capacity, 21 ft. × 8 ft. × 6 ft., with three compartments. Price £87.10.0, per tank.

The tanks are constructed at the works and then taken down for shipment.

(b) *Capacity 8 to 10 cwts. of palm fruit per hour.*

The smaller plant for treating 8 to 10 cwts. per hour consists of the following items :—

(1) Elevator for raising fruit to receiving bin for digester.

(2) Receiving bin.

(3) Digester.

(4) Centrifugal extractor (40 ins. diameter).

(5) Double steam jacketed spiral conveyor drier for nuts and fibre from centrifugal extractor, working in conjunction with exhaust fan for exhausting vapours.

(6) Elevator for raising nuts and fibre to separating screen.

(7) Driving gear for conveyor drier.

(8) Hexagonal rotary separating screen for separating nuts and fibre.

(9) Elevator for raising nuts to receiving bin over nut crackers.

(10) Receiving bin with necessary supports.

(11) Two nut cracking machines mounted on frame, supporting revolving screen for separation of uncracked nuts.

(12) Brine tank.

Total price of the above plant £1,610.0.0, plus 6 per cent. for packing for shipment and delivery f.o.b. English port.

The makers state that for the above plant it will be necessary to provide about 35 B.H.P. for driving, and an extra 300 lbs. of steam per hour for use with the digester and conveyor drier.

A rotary drier, similar to that described for the larger plant, in order to utilise the exhaust gases from the boiler for drying the nuts and pericarp refuse can be supplied at an extra cost of £50.0.0.

From observation of the plant in the Nigerian Court of the West African Pavilion at the British Empire Exhibition the writer can confirm the maker's statement that the initial cost of the plant is low,

operating expenses are cheap, and further the plant can be worked without skilled labour.

Culley Process.

As far as the writer is aware, the only other firm exhibiting oil palm machinery at the British Empire Exhibition is Culley Expressors Ltd. Unfortunately their machinery is not in operation so that the efficiency of the plant, especially in regard to the depericarping machine, which is such an essential feature of this process, cannot be judged.

Assuming that the depericarping of the fruit before extraction of the palm oil is necessary, a satisfactory method of carrying out this separation mechanically has hitherto presented many difficulties, as is evident from the number of machines designed and patented for this purpose from time to time. It is claimed that the Culley depericarper has solved the problem satisfactorily.

The following is a brief description of the process.—The fresh ripe fruit is fed into a steriliser, which consists essentially of a steam jacketed kettle, but no steam or water comes in contact with the fruit and no agitators are used in the kettle. The fruit takes about half an hour to pass through the kettle, and is thus heated thoroughly before being fed into the depericarper. This machine removes the pericarp from the nuts in a continuous operation without the use of screens or water, and discharges the clean nuts into a chute from which they are taken away for storage and drying, so that the kernels can shrink before the nuts are cracked.

The pericarp is collected on a travelling band, which delivers into a receiving tank fitted with two strainers on a movable frame, so that when one of the strainers is full, the other may be moved into position. The contents of the strainer are discharged into a steam driven centrifugal extractor, fitted with a perforated metal basket. Exhaust steam is used for heating the basket so as to facilitate the flow of oil.

The oil from the extractor is collected in settling tanks, fitted with closed steam coils, in order to heat the oil, so as to coagulate mucilage and other suspended matter, which settle to the bottom. The oil is then passed through a filter press into storage tanks from which it is run into barrels for shipment.

(Note : -Although no filter presses are included in the Manlove Alliott process, it may be found preferable in that case also to filter the oil before shipment).

A hand operated machine capable of treating at least 2 cwt. of fruit per hour is also made by this firm for small holders. In this case the separated pericarp is reheated and pressed in a hand-operated screw-press or the oil may be separated by treating the heated pulp in a small steam-driven centrifugal extractor.

The following estimate and details have been supplied by Culley Expressors Ltd. :—

(a) *Capacity 10 cwt. of palm fruit per hour.*

The items are as follows:—

(1) Sterilising kettle, steam jacketed.

(2) Set of elevators for lifting fruit from kettle to depericarping machine.

(3) Culley's patent depericarping machine.

(4) Drip tray for depericarper.

(5) Fibre and oil collecting tank.

(6) Travelling pulley block for lifting weights up to 5 cwt. (Runway joist not included).

(7) No. 4 patent steam driven turbine centrifugal oil extractor, fitted with two removable perforated steel baskets.

(8) Swing crane for lifting baskets from centrifugal extractor.

(9) Steel channel for conveying oil from centrifugal extractor to receiving trough.

(10) Receiving trough.

(11) Settling tank, capacity 10 tons, divided into two compartments and fitted with steam coils.

(12) Double set of pumps (with supporting bracket) for pumping palm oil from receiving trough and fibre and collecting tank.

(13) Filter press, capable of dealing with oil from 1 ton of fruit per hour.

(14) Steel channel for conveying oil from filter press to storage tank.

(15) Storage tank, capacity 10 tons of oil, fitted with steam coils.

(16) Necessary piping for steam heating and conveying oil.

(17) Four tipping bogies, capacity 4.8 cubic feet. Two for removing the cleaned nuts from the depericarper and two for removing the pericarp from the centrifugal extractor.

(18) Requisite nut-cracking machines and plant for separating kernels from shells.

Total price of the above plant £2,500.0.0., packed for shipment and delivered f.o.b. English port.

(b) *Small hand-operated plant.*

(1) Culley patent hand-operated depericarping machine. Price £45.0,0.

(2) Culley-Ducolson hand screw press. Price £14.0.0.

(3) Patent turbine centrifugal oil extractor, steam driven. Price £93.5.0. The centrifugal extractor requires from 70 to 96 pounds of steam per hour, according to steam pressure available, but under 3 H. P. boiler rating. No shafting or belting is required.

The centrifugal extractor is recommended as giving much more efficient results than the hand screw press.

Remarks and Conclusions.

The writer is convinced from his observation of the plant at the British Empire Exhibition that the problem of a simple, efficient and economical process for the extraction of palm oil has been solved satisfactorily.

The essential differences between the processes of Messrs. Manlove Alliott & Co., and Culley Expressors, Ltd., are that in the former process the whole fruit is treated direct in the centrifugal extractors after digestion with live steam at low pressure, whereas in the Culley process the pericarp is first separated in a special depericarping machine, after the fruit has been heated in a digester with no direct contact of steam.

It is stated that direct contact with live steam is liable to decompose the oil into free fatty acid and glycerine, thus yielding a somewhat inferior oil with consequent loss of glycerine in the water from the condensed steam. From actual experience with the treatment of palm fruits with either boiling water or low pressure steam, the writer is of the opinion that this factor is of little or no significance.

The treatment of pericarp alone in the centrifugal extractors, as in the Culley process, will mean a larger output from those machines, since the nuts are not introduced, but it must be remembered that an extra operation, namely depericarping, involing the use of a special machine, is thereby included.

As stated before, no definite decision can be laid down as to the respective merits of the two processes in the absence of a direct comparison of the two machines in operation. It can be stated, however, that the plant constructed by Messrs. Manlove Alliott & Co., carries out the various operations efficiently and automatically, is simple in operation and appears to be economical, and it is of interest to note that Tennamaram Estate, the largest palm oil producing estate in Malaya at present, has already ordered one of these plants.

It is to be hoped that the solution of this problem will give a renewed impetus to the cultivation of the crop in this country.

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FODDER AND GRAZING GRASSES IN MALAYA.

By J. N. Milsum.

TO those who appreciate the value of a well maintained pasture, it is a matter of wonder that this important aspect of agriculture is so neglected in the Malay Peninsula. Where grass is required as fodder for cattle at the present time, it is the general rule to have the supplies collected daily from swampy land in the neighbourhood. The kind of grass cut varies according to the district, situation, and person employed in collecting the fodder. Whereas some grass-cutters will take almost any low vegetation sufficiently long to cut, others will show a certain amount of discrimination and collect those grasses, which are succulent and preferred by cattle. In open swamps the best species is *Leersia hexandra*, a tall, slender marsh grass with narrow leaves. This grass frequently occupies large areas and is widely distributed throughout the Peninsula. It is relished by cattle, and is one of the best native fodder grasses.

In the general absence of enclosed pastures in this country, it is a matter of considerable difficulty to effect improvements to the turf on a basis that is economically sound. The system of growing paddy as practised by Malays on the river banks in Pahang, known as tenggala cultivation, is a native method of utilizing a three to four-year fallow for the production of fodder for buffaloes and other cattle that are employed in the cultivation of paddy. The predominating species occurring on such land is the Love grass, *Chrysopogon aciculatus*. This practice is generally well known and requires little further mention as being only applicable to types of land that are comparatively flat with a high water-table. On dryer areas, unless special attention be given to the land, the soil becomes invaded with lalang (*Imperata arundinacea*) to such an extent that the more desirable grasses have little chance of becoming established. The best existing pastures are those sometimes met with as reclaimed swamps on estates; the land here has been cleared of all tall growth and drained, resulting in a thick mat of broad-leaved grasses, which is usually composed of the following species.—*Paspalum platycaule*, *P. conjugatum*, *Isachne australis*, and *Panicum indicum*, with a number of low sedges such as species of *Kyllingas*, *Scleria* and *Fimbristylis*. These grasses provide a pasture very suitable for grazing cattle, being low, dense and succulent. Such land is, however, not always available and it is evident that the dryer types of land must receive some consideration from a number of standpoints. It is desirable, therefore, that investigations be directed to ascertain what grasses will thrive on the ordinary land of the country and what methods should be adopted to maintain the desirable species in a permanent state.

On dry open land, observations tend to show that *Zoysia pungens*, a small tufted, glabrous, much branched grass, occurring generally throughout the country, is a valuable grazing grass. In some districts this grass is very common, especially in sandy spots near the sea, often forming a dense turf. Cattle graze it readily.

The question of temporary pastures is one that can be but briefly touched at present as though there are a number of suitable fodder plants, the expense incurred in their cultivation is frequently such as to prohibit their general acceptance, more especially by natives. There are, however, several fodder grasses that produce a high return for a moderate amount of cultivation and it appears quite possible that should these be grown in rotation with suitable leguminous crops, a valuable fodder might be obtained with profit. Several such grasses have proved satisfactory under cultivation at the Experimental Plantation, Serdang, Selangor.

The subject of fodder and grazing grasses may be classified conveniently under two headings:—

(*a*) Stall Feeding.

(*b*) Pasture Land.

The following grasses have shown themselves satisfactory under trial: —

Stall Feeding.

Guinea Grasss, *Panicum maximum.*

Mauritius Grass, *Panicum muticum.*

Napier Grass, *Pennisetum purpureum.*

Pasture Land.

Dallis Grass, *Paspalum dilatatum.*

Carpet Grass, *Axonopus compressus.*

Stall Feeding.

Undoubtedly the most satisfactory grass for this purpose is Guinea Grass. This grass has been referred to as the best forage grass in the world and results to date prove conclusively its value in the Malay Peninsula.

Guinea Grass, *Panicum Maximum.*

A large perennial grass, forming a great number of suckers and thereby growing into large stools. Height 4 to 7 feet. A native of tropical Africa, it is now commonly grown throughout the tropics as a fodder grass. At the Experimental Plantation, Serdang, cattle have been fed continuously on this grass as a sole fodder with excellent results. In Sumatra, where the Deli Pony is employed in the towns, there is a considerable demand for this fodder. This is met by the cultivation of small plots of Guinea Grass in the majority of native holdings in the vicinity of the towns. Guinea Grass is largely

cultivated in Hong Kong for the purpose of providing fodder for dairy cattle. It is also used extensively in the West Indies, Java and the Philippine Islands.

Palatableness is the first consideration with forage plants and Guinea Grass is eaten greedily by cattle, horses and goats. Trials instituted by the Department of Agriculture, Ceylon at the Experimental Station, Peradeniya in 1922, to ascertain the relative palatableness of a number of grasses under trial there, showed this grass to be easily first in favour with cattle.*

Soils.—This grass adapts itself to a wide range of soils, but prefers a sandy well-drained soil, which is fairly moist. Ravines and other damp places in the estate may be utilized for the cultivation of this fodder, provided the water-table is sufficiently low. On dry exposed land the quantity of fodder decreases and the grass is less palatable to cattle on account of the stiffness of its growth and higher fibre content.

Preparation of the Land.—The area to be planted should be situated as near as possible to the place where the forage is to be fed to facilitate transport. The land should be clean cleared and well cultivated to a depth of ten inches. If the land be subject to heavy wash, steps should be taken by silt pitting or other means to prevent rain water from damaging the surface soil and washing out the newly-planted divisions.

Propagation.—The grass may be propagated either from seed or from divisions. The latter is the more satisfactory method, but, when a commencement is to be made to establish this grass, the former method may be adopted. Seed is not, however, produced in much abundance and is generally difficult to obtain. Fresh seeds germinate readily, and should be sown thinly in prepared beds and subsequently transplanted to the field. The seedlings are ready for transplanting in three weeks from germination and receive no check if planted out during showery weather. The first crop of fodder may be cut within three months from transplanting.

Divisions may be planted any time except in very dry weather. The best results are obtained when the beds are laid out at the commencement of the rains. In planting it is important that the soil be pressed firmly around each plant. The first cutting may be made in three to four months time.

The planting distance recommended for both seedlings and divisions is three feet by three feet square. When planted on poor land or in a dry situation, the distance may be reduced six inches either way.

Little cultural attention is required after planting beyond an occasional stirring of the surface soil to keep down weeds, and during dry weather to prevent undue evaporation. The loose earth may be slightly mounded around the stools.

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* Trop: Agriculturist. Ceylon. Vol: LIX. No. 4. p.216.

Production.—A yield of about 7,000 lbs. of green fodder may be cut from an acre every four weeks or approximately forty tons per acre per annum. A heavier yield per cutting is obtained during the rains, but this is an average figure for the year, At the Experimental Plantation, Serdang, an area of half an acre of land is found sufficient to produce enough fodder to feed two pairs of bullocks, allowing each animal the grass from one chain of stools, i.e., twenty-two plants per day. The area measures five chains by a chain and by cutting four rows per day the grass is grown sufficiently to recommence cutting again when the plot has been worked through.

An average daily ration is found to be about 50 lbs. of fresh grass in addition to the usual ration of cereal food. The latter for working bullocks consists of a pound of broken rice and 5¼ lbs. of bran with a dash of salt and a little coconut oil. When commencing to feed animals on this grass, care should be taken to mix it with ordinary grasses in the first instance so as to enable the cattle to become accustomed to it by degrees. If fed as a sole fodder ration suddenly, it is occasionally liable to act as a laxative.

Manuring.—After the fourth cutting, an application of twenty cartloads of well-rotted cattle manure per acre should be placed between the rows of grass and lightly changkolled in. To maintain heavy yields of fodder, this operation should be repeated every six months. The amount of fodder being continuously removed from the land is so large that frequent heavy dressings of manure are necessary.

Replanting.—When a plot has been under this grass for a time, a deterioration in production and quality is noted. The stools become large and burdened with a quantity of old growth. This may occur within two to three years according to the condition of the land. When this occurs, the stools should be lifted and divided, and the land thoroughly cultivated and replanted with divisions. When practicable, it is advisable to seek fresh land and crop the old area with ground nuts or some other leguminous plant.

The following analyses of Guinea Grass were made at the Bureau of Science, Manila* and the Department of Agriculture, Ceylon†.

	Philippine Isles. per cent.	Ceylon. per cent.
Water	... 77.85	77.26
Ash	... 2.85	3.30
Proteids	... 3.34	3.47
Carbohydrates	... 8.09	8.90
Fat	... .57	.55
Woody Fibre	... 7.30	6.53

* Philippine Agricultural Review, Vol. VII, No. 5, p. 211.

† Tropical Agriculturist, l.c.

Mauritius Grass, *PANICUM MUTICUM.*

A strong, creeping, perennial grass, of rapid growth, producing a large amount of palatable fodder. It attains a height of about 6 feet. This grass is now widely grown in the tropics and is stated to be found in a wild state in South America. In Ceylon it is well known as a fodder, but is rarely met with in this country. It thrives in moister conditions than does Guinea Grass.

This grass grows well at the Experimental Plantation, Serdang, and has also been grown with considerable success by the Assistant Agricultural Inspector, Perak South, on a small plot of state land at Kampar, Perak. This officer has supplied some notes on the behaviour of Mauritius Grass as a fodder in that State, and these have been incorporated here.

Soil.—This grass is a heavy feeder and requires plenty of moisture. On dry sandy soil, coarse growth is made and the plants eventually die out. The land should be prepared as in the case of Guinea grass with plenty of well-rotted manure incorporated in the soil.

Propagation.—This grass is increased by division of the runners. These root readily if cut into pieces of two or three joints each and pushed into freshly cultivated land, so as to leave the upper joint at about the surface of the soil. The divisions may be planted fairly closely, i.e., 1 to 2 feet apart according to situation. It is necessary to keep the land clean for the first two months after planting, when its growth becomes sufficiently dense to keep down weeds.

Production.—The first cutting may be made in two to three months from planting, when the plants are just throwing up their flower spikes. Subsequent cuttings may be made every two months or so, except in dry weather when growth becomes closer. A yield of about 35 tons of green fodder per annum is obtained from an acre. Each cutting, except during dry weather, yielding at least 5 tons of palatable fodder. Considerably higher yields are reported to have been obtained at Kampar, Perak.

Cultivation.—The land should be cleared and replanted every 2—3 years as in the case of Guinea Grass, and, where possible, a fresh area should be taken under cultivation and the old area be given a change of cropping. Heavy manuring is necessary to maintain high returns of fodder.

The analysis below is given by the Department of Agriculture, Ceylon, in the paper already referred to.

	Per cent.
Moisture ...	76.30
Ash ...	3.00
Proteids ...	1.40
Carbohydrates ...	12.20
Nitrogen ...	.23
Woody Fibre ...	6.80

Napier Grass, *PENNISETUM PURPUREUM*

A tall perennial grass, native of tropical Africa, growing in clumps, and attaining a height of 18 feet. It was first cultivated in Rhodesia in 1909, and from there it has been introduced into most tropical countries. This grass is of recent introduction here and, though but little information is as yet available regarding its behaviour in this country, results to date at the Experimental Plantation, Serdang, indicate it as a fodder crop of probable value in Malaya.

Propagation.—Seeds are produced in this country and germinate readily, though the most convenient method of propagation is by the use of stalks as in the case of sugar cane cultivation. Well-matured canes should be selected and cut into lengths with two joints, cutting about an inch beyond each joint. On average land the planting distance should be about 5 feet by 5 feet square.

Cultivation.—The land to be planted should be well cultivated and the soil reduced to a fine tilth. Planting should be carried out during wet weather to ensure the cuttings making a good start. The joints should be pushed into the ground with the upper end flush with the surface.

The first cutting is ready to be taken in six months time from planting and subsequent cuttings may be taken every four to six months according to season. When mature Napier Grass becomes woody, thus frequent cuttings are necessary to avoid this. No definite records are as yet available in this country as to the yield from this grass. It is estimated that at least 60 tons of fresh fodder per annum can be obtained under average conditions though this might often be exceeded.

Further experiments are required to test the palatableness of this grass to cattle under local conditions. A preference is shown for softer grasses, but this is thought to be due to the fact that so far the fodder has been fed too old. The United States Department of Agriculture state* that Napier grass is eaten eagerly by all kinds of farm cattle.

Merker grass is a variety of Napier grass that differs in having a more slender and glaucous stalk; it stands more erect and has slightly narrower leaves. The flower spikes appear earlier than those of Napier grass. Of the two varieties, Merker grass gives the lower yield of green fodder.

Pasture Land.

The amount of work and the expense incurred in laying down a pasture of pure grass in this country are heavy and experience to date causes considerable doubt as to whether it is an economic proposal. Two imported grasses have so far shown themselves of value for this purpose, but other grasses of likely value are under

* Farmers' Bulletin No. 1254, p. 25. Washington, U.S.A.

trial. The difficulty experienced is to find suitable grasses with a sufficiently close habit to exclude undesirable weeds and other grasses. Dallis grass and carpet grass have so far been found fairly satisfactory in this respect. Experiments to date have shown that it is very difficult to secure a good pasture by means of seed. There are a number of factors causing this, the principal of which are the presence of numerous ants which remove the seed and the heavy rains frequently experienced in this country. The most satisfactory means of establishing a pasture is by means of dibbling in divisions or runners on a prepared surface.

Dallis Grass, *PASPALUM DILATATUM.*

This grass is stated to be a native of the Argentine, but is now cultivated throughout the Southern United States, and Australia and is known in Ceylon.

Dallis grass was introduced into the Peninsula about twenty years ago and Ridley writing in 1906* comments favourably on it as a pasture grass. It does not, however, appear to have become naturalised, probably, because the damp, warm, conditions of this region are unfavourable to its spread by means of seed. It is a perennial, with a deep, strong root system and bunching habit of growth, attaining a height of 1½ to 2 feet.

Dallis grass is rather difficult to establish, as it does not spread by runners. Seeds should be sown in prepared beds and when the plants are of sufficient size, they should be lifted during suitable weather and split up into divisions. A suitable planting distance is about 1 foot apart each way. At first, growth is inclined to be patchy and frequently some supplying is necessary. It covers the land well in time and provided it is clean, little weeding is necessary.

Definite information as to the wearing qualities of this grass and subsequent treatment of the land are as yet not available.

According to the Department of Agriculture, Ceylon, the food units of Dallis grass are very high (l.c.). The analysis is given as under:—

		Per cent.
Water	-	64.40
Ash	-	3.18
Proteids	-	3.03
Carbohydrates	-	18.36
Nitrogen	-	.48
Woody fibre	-	10.00

* Agric. Bull, S.S. & F.M.S. Vol. V, p. 113.

Seed of this grass is produced in quantity in Australia and is obtainable from Seed Merchants in that country. Sown broadcast, the seed rate is given at 10 lbs. per acre.

Carpet Grass, *Axonopus Compressus*,

Carpet grass is a native of the West Indies and is now employed extensively as a fodder grass in the Southern United States. It is a perennial pale-green grass, spreading by creeping stems which root at every joint, forming a close compact turf. The flower stems grow to a height of 1—1½ feet and are very slender. It is well suited for light soils. In the Gulf region of the U.S.A., it is said to stand close grazing and heavy trampling better than any other grass.

This species is of recent introduction at the Experimental Plantation, Serdang, and has shown itself a valuable acquisition. It is readily raised from imported seed, but, owing to its creeping habit, it is well adapted to propagation from runners. There is yet some doubt whether the quantity of fodder produced will warrant its extensive use as a grazing grass in Malaya, but its trial for this purpose is at present in progress.

Carpet grass is of considerable value as a general utility grass and, when kept closely cut, it forms an excellent turf. It is considered to be of possible use on the fairway of golf courses in the Peninsula, though too coarse as a grass for putting greens and tennis courts.

Summary.

(1) The present position of feeding cattle in this country is discussed.

(2) The results of stall feeding with various grasses obtained to date at the Experimental Plantation, Serdang, show Guinea Grass to be a suitable fodder. Trials with Mauritius Grass and Napier Grass are as yet incomplete.

(3) The question of establishing pastures is under experiment, and, so far, two imported grasses, namely, Dallis Grass and Carpet Grass have shown themselves promising.

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A PRELIMINARY REPORT ON CARPET GRASS.

By J. Lambourne.

CARPET grass, also known as Louisiana grass, is a native of the West Indies, but is now distributed throughout the southern United States and from Mexico southward to Argentina and Chile. It is considered the most valuable grass known for permanent pastures on the sandy soils of the southern Coastal Plain region of the United States (1).

A small quantity of seed was received in 1921 from the Bureau of Plant Industry, United States Department of Agriculture, Washington. The seed was sown early in 1922 at the Experimental Plantation, Serdang, Selangor, and from the stock thus obtained it has been found possible to plant up a comparatively large area. Carpet grass soon established itself by natural seeding in several parts of the Experimental Plantation, though it has showed no signs of becoming a troublesome weed. At the time of writing, beside the trial plots, which are capable of supplying a large amount of planting material, the grass has been used to cover bare terraces and banks around the plantation bungalows and to form edges to roads and drains. In addition, cuttings have been supplied for trial at the golf course under construction at Frasers' Hill, Pahang, (alt: 4,000 feet) where it shows signs of being a suitable grass for 'through the greens.' Seed and cuttings have been distributed to various places in the Peninsula.

Carpet grass is a perennial, pale green, creeping species forming a dense turf, easily distinguished by the compressed two-edged creeping stems, rooting at each node, and by its linear, blunt tipped leaves. The inflorescence is digitate or subdigitate, borne on long slender peduncles from one or two feet long. Two or three flowering stems are produced from the terminal node and three, and sometimes four, spikes are carried at the tip of each peduncle. The first glume of the spikelet is wanting, and this, together with its flattened stem, blunt tipped leaves, and digitate or subdigitate inflorescence are the main distinguishing features.

There is as yet some uncertainty as to the correct nomenclature of Carpet grass and from information received from Prof. C. V. Piper, Senior Agronomist in Charge of the Bureau of Plant Industry, United States Department of Agriculture, it is hoped that the identity of this grass may be settled in the near future. The name *Axonopus compressus*, by which it is still known, has now been used for a similar grass, previously referred to by Ridley as *Paspalum platycaule*, Poir, (2). The latter grass, also a West Indian plant, though only differing in slight respects botanically from Carpet grass, presents considerable differences in habit when viewed growing side by side, and from an agronomical standpoint is much inferior. In the meantime, the more recent introduction may be referred to as *Axonopus compressus*, to which the name Carpet grass applies primarily.

Propagation and Cultivation.

The best method of propagation is by runners which are produced in abundance. These are dibbled into the soil, and within two months, providing the weather is moist, a good covering is formed, which if mown, forms a thick close turf very suitable for lawns or for 'through the greens' on golf courses.

Carpet grass is the best grass for this purpose in Malaya, so far seen by the writer, especially as it covers the land almost to the exclusion of all other grasses and weeds. Flowering stems are produced sparingly and the seeds have not the same objectionable characteristic as in the case of 'Love grass' (*Chrysopogon aciculatus*) which establishes itself on most lawns and golf courses in this country. It has not yet been ascertained whether Carpet grass will hold its own against Love grass, but judging by its strong growth, even on fairly poor soils, there is reason to think that it will do so.

On the trial plots at the Experimental Plantation, Serdang, this grass has been allowed to grow at will for over a year without cutting or weeding, except in the early stages of growth. On recent examination, it was found that only a few of the coarser grasses and a small amount of the Sensitive plant (*Mimosa pudica*), had established themselves amongst it. Where the grass had been mown regularly, however, it had remained practically pure.

Carpet grass may be propagated from seed, produced freely when the flowering stems are left uncut. The great difficulty is the collection of seed in quantity owing to depredations by rice birds.

As a grazing grass, there appear considerable possibilities for this species, though there is as yet some doubt whether the quantity of fodder produced will warrant its extensive use.

Soils.

In the Gulf States of the U.S.A., where it is grown extensively as a grazing grass, Carpet grass is said to be especially adapted to sandy loam soils, favouring land having moisture near the surface. On such soil, it will occupy the land in practically pure growth, especially under heavy grazing and trampling. At the Experimental Plantation, Serdang, it has been grown successfully on both sandy loam and lateritic soils. It appears to grow on any type of soil in this country if the moisture conditions are favourable. It stands up well during dry weather though making little growth during such periods.

References :—

(1) Farmers' Bulletin 1130, United States Department of Agriculture.

(2) Materials for a Flora of the Malay Peninsula, Monocotyledons, by H. N. Ridley, volume III.

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SOME OBSERVATIONS ON ROOT DISEASES OF HEVEA BRASILIENSIS.

A. Sharples.

TWO recent articles by Dr. C. van Overeem and Dr. C. van Overeem and Dr. A. Steinmann have to be recorded and considered in relation to our knowledge in Malaya. Regarding the article on "The Red-Root fungus of Hevea Brasiliensis," (2) the writer has been in communication with Dr. van Overeem and specimens have been exchanged. In this article Drs. van Overeem and Steinmann suggest that the fungus causing the well-known " Wet Rot" of Rubber roots in Malaya and named provisionally " *Fomes Psuedo-ferreus* " by Wakefield (1) from specimens developed in pure cultures by Belgrave, is the same as the fungus commonly found in West Java and named *Ganoderma ferreum* (Berkley) van Overeem and Steinmann ; snd that " Wet Rot of Roots of Hevea Brasiliensis" in Malaya is the aame as " Red Root of Hevea Brasiliensis" in Java.

In the interchange of specimens, old fruit-bodies from Belgrave's pure cultures were sent to Dr. van Overeem, who regarded the specimens as probably approximating to *Ganoderma ferreum*, although the typical spores were absent. The writer obtained from Dr. van Overeem typical fruit bodies of *Ganoderma ferreum* (Berkley) van Overeem and Steinmann, which appears to be found quite commonly in Java. The fructification sent by Dr. van Overeem has been examined closely by various authorities in Malaya and all are agreed that this fungus has never been found associated with Wet-Root Rot in Malaya. Pinching, Senior Officer on the Scientific Staff of the Rubber Growers' Association in Malaya however, has accepted *Ganoderma ferreum* in one of his latest articles (5).

In connection with the statement of Drs. van Overeem and Steinmann (l.c.) " that this species should be called " *Ganoderma ferreum* (Berkley) van Overeem and Steinmann, and the name *Fomes psuedo-ferreus* (Wakefield) be considered synonymous" the writer considers that sufficient evidence has not been adduced to allow this statement to be accepted. Belgrave (1) in his investigation worked out the life-history of the fungus and its parasitic nature along the required lines, by obtaining pure cultures, successful inoculations and re-isolations. Drs. van Overeem and Steinmann have obtained much general field evidence regarding the identity of *Ganoderma ferreum* with a Wet Rot of Hevea roots in Java, but as regards actual proof, only to be obtained by pure culture work etc, they have offered no substantial evidence for regarding *Ganoderma ferreum* as synonymous with *Fomes psuedo-ferreus.*

To the layman, the question of naming may seem of small importance but there is a wider significance as a result of the writer's investigations on " Brown Root Disease" (6). Brown Root Disease is a factor of some importance in the cultivation of many tropical

crops and the causal fungus was usually assumed to be *Hymenochaetae noxia* (Berk) (4. p. 48) because this fungus was so commonly found associated with the disease; later Petch has changed this finding for Brown Root disease of *Hevea brasiliensis*, which he now regards as caused by *Fomes lamaoensis*, (Murr) *Hymenochaetae noxia* being a stage in the life history of *Fomes lamaoensis* (4.p.48). Again it should be remarked that as far as the literature has been studied, constant association of the fungus and diseased roots is the basis on which finding is made, and this evidence cannot be accepted as final. The writer studied comparatively :—

(1) Brown Root disease of Rubber roots from Ceylon.

(2) Brown Root disease of Rubber roots from Malaya.

(3) Brown Root disease of Camphor.

(4) Recently some work has been done on a Brown Root disease of *Aleurites montana*.

In these cases, four distinct fungi were isolated. The first three have all been inoculated into rubber seedlings and each one was capable of penetrating the tissues to a greater or less degree. Apart from the fungus obtained from Camphor roots suffering from Brown Root disease, all the fungi isolated, including that obtained from diseased roots of *Aleurites montana*. showed the same pecularities when grown in pure culture on rubber wood blocks. These were the rapid growth of the fungi in the tissuses of blocks, as shown by a copious exudation of drops of a clear gummy or resinous nature, and by the copious production of mucilage in contact with water. The fungus from Camphor Brown Root was out of line because of a yellowish-brown mycelium, which grew rapidly over the blocks to completely cover them.

The observations made in Malaya furnish strong evidence for considering that more than one fungus is concerned in causing Brown Root disease on the varied tropical cultivations. The characteristic symptoms of Brown Root disease, i.e. binding together of masses of loose soil and small debris into a firm mass around diseased roots, without doubt would be brought about by any fungus possessing the power of attacking the wood and producing mucilage when in contact with sufficient supplies of moisture ; in effect there are many different morphological species of fungi cabable of causing Brown Root symptoms because they are similar in the physiological attributes.

A similar explanation appears more feasible to the writer regarding Red Root disease of Java, and "Wet Rot of Rubber in Malaya" i.e. probably two different fungi producing similar symptoms. Drs. van Overeem and Steinmann however, should have no difficulty in clinching the matter if pure cultures of *Ganoderma ferreum* are set up, when a comparison of the fruit-bodies, which appeared frequently in Belgrave's pure culture work, could be made and all further doubts set at rest,

The second article (3) by Dr. van Overeem is of interest in dealing with the fungus *Ustulina zonata* (Lev) Sacc which is responsible for many losses in rubber plantations.

Ustulina vulgaris Tul. and *Ustulina zonata* (Lev) Sacc have up to date always been considered two different species. *Ustulina vulgaris* is known to occur frequently all over the world and is a genuine cosmopolitan, whereas *Ustulina zonata* is only known to occur in Tropical Asia (India, Ceylon, Malay Archipelago). Dr. van Overeem, in an extensive resume, has provided strong evidence for considering the two species identical and suggests the name *Ustulina maxima* (Web) von Wettstein, to include *Ustulina vulgaris* and *Ustulina zonata* which were previously considered distinct species.

Apart from the scientific interest, there is a practical aspect in regard to Dr. van Overeem's paper. He mentions the extraordinary variability of the tropical form of *Ustulina maxima* (Web) von Wettstein (i.e. U. zonata), a feature which was stressed by the writer (7). Petch (4 p. 144) in Ceylon and the mycologists of the Rubber Growers' Association in Malaya have called attention to the fungus *Kretzschmaria micropus*, which is given as a wound parasite on *Hevea brasiliensis*. The writer (?) and now Dr. van Overeem have both called particular attention to the "Kretzschmaria" stage of *Ustulina zonata*, for it is often found both in pure cultures and in close association with the ordinary plate-like form of the fungus in nature. No good can accrue to the rubber industry by unnecessarily multiplying the number of names of fungi supposed to be capable of causing diseases of *Hevea brasiliensis* and there seems no adequate reason in the present stage of our knowledge for considering the "Kretzschmaria" fungus associated with symptoms similar to those attributed to *Ustulina zonata* as other than an expression of the extreme variability in the growth forms of this fungus.

(1) Belgrave, W. N. C. - A Wet-Rot of Para Rubber Bull. No. 28, Dept. of Agr., F.M.S.

(2) Overeem van, C. Dr. and Steinmann, A. Dr. - Over De Roode Worteschimmel van *Hevea Brasiliensis*: M.A. Archief voor de Rubber Culture. Oct. 1923.

(3) Overeem van, C. Dr. - Uber *Ustulina vulgaris* Tul. und *Ustulina zonata* (Lev.) Sacc. Bull. du. Jardin Botanique Buitenzorg—Serie III, Vol. VI, Juillet 1924.

(4) Pinching, H. C. - A consideration of the present condition of the earliest Hevea plantings in the East. Report of Int. Rubber Conference. Brussels, published by Rubber Growers' Association.

(5) Petch, T. - Diseases and Pests of the Rubber Tree. 1921. Macmillan & Co.

(6) Sharples, A. - A preliminary account of Observations on the Fungi causing Brown Root Disease.
Malayan Agricultural Journal, Vol. X, July 1922, No. 7.

(7) Sharples, A. - *Ustulina zonata* (Lev.) Sacc. Anns: of App: Biology, No. 4, March 1918.

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